



A Comparative Analysis of Nordic and Major European Equity Markets in the Wake of Covid-19

Examining Volatility, Performance, and Investor Sentiment Amidst the Crisis

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Bachelor's Thesis

October 2025

International Business

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A Comparative Analysis of Nordic and Major European Equity Market in the Wake of COVID-19

Jyväskylä: JAMK University of Applied Sciences, September 2020, 43 pages.

Degree Programme in International Business. Bachelor's thesis.

Permission for web publication: Yes

Language of publication: English

Abstract

Covid-19 impacts on Nordics and Major European stocks markets has been analysed. The selected indexes OMXH25, OMXS30, Nordic 40, DAX20 and FTSE100 OMXC 30 has been used to calculate their risk-return performance. The data for the analysis has been collected from the Euronext and Nasdaq website. Furthermore, the descriptive analysis and correlation calculations has been made using SPSS and Excel. The basic calculations were made on excel while SPSS was used for calculating the correlation, because of larger data volume. Various base theories were discussed such as Risk-return, CAPM, Portfolio and Arbitrage Pricing Theory. Countries like Finland, Denmark, Uk were the countries to implement strict rules during the pandemic while, Sweden approach to Covid-19 was debatable at first.

Finally, the Covid-19 pandemic has impacted the Nordic and Major European markets, and the index performance were seen better before Covid than during and after Covid-19. The hypothesis presented has been supported by the results. However, the time frame was limited and different factors affecting equity markets were not considered which was a limitation.

Keywords

COVID-19, Stock Market, Descriptive Analysis, Correlation Analysis

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1 Introduction

The chapter one for this study will introduce the research motivation along with the research objectives and questions. This study is presented to conduct research on the one of the biggest crises of the history, Covid-19 a dangerous pandemic which took a life on nearly two million people only on the Europe, counting to overall 18.2 million deaths around the world (Larkin 2022). The dangerous coronavirus disease not only caused human deaths all over the world it also caused the financial markets to fall sharply even crashing the biggest stock markets in the European region.

Therefore with the help of this study, we are tending to establish a comparison between the stock market performance of Nordic countries and major European markets to identify specific challenges and opportunities resulting from Covid-19. Through an analysis of market data, economic trends, policy responses, and expert views, this research paper aims to show the significant factors that shaped the response of these two regions' markets to the pandemic.

1.1 Research Motivation

Understanding how the pandemic has impacted equity markets, the Nordic region and major European economies is crucial for numerous reasons. Equity markets are considered as the key element to measure the economies around the world. Equity markets reflect the analysis of the financial position of different economies therefore, analysing the pre and post covid situation will give us the perspective to look after the changes during the pandemic period.

European economies and Nordic economies vary in terms of technology, infrastructure, manufacturing and economic models. This leads to differences in the country's financial performance and equity market fluctuations and growth (Aiginger & Guger, 2006). The effectiveness of the policies, structure, regulatory framework of the economy in the countries and the way of dealing with the uncertain pandemic situation can be compared by looking how the equity market performed during the risky situation. Therefore, understanding how the covid -19 impacted, can be helpful for the policymakers, investors and stakeholders to identify the risks and challenges as well as the opportunities in the near future. The study of investor behaviours, trends, and weaknesses will give policymakers a clear view for better decision making to support the economic crisis and its recovery during the hard times.

Overall, the research aims to add a current understanding on the impacts of covid -19 pandemic and offers insights for the investors, policy makers and stakeholders for sailing across the post pandemic economic landscape.

1.2 Research Objectives

Objectives can be considered as a guiding framework for the research. Research objectives are:

1. To analyse the performance and volatility of selected Nordic and major European stock indexes during Covid-19.
2. To evaluate post Covid-19 performance and recovery pattern of the Nordic 40, OMX Helsinki 25, OMX Copenhagen 30, OMX Stockholm 25, DAX 20, and FTSE 100 UK.

Research Questions:

1. How did the performance (returns) in the Nordic region and major European stock indexes evolve during covid-19 crisis?
2. How did volatility and risk levels of the selected indexes change during and after the COVID-19 crisis?

The questions and objectives are always work together to achieve a common goal. The first objectives will help to build the strong base for the study by analysing the performance and volatility of the selected indexes. The second objective will further explore the impact created by pandemic and observe the market indexes reaction during and post pandemic. Together all these elements combine to justify the main research question provides the understanding of market resilience in a post pandemic context.

1.3 Thesis Framework

This thesis has six main chapters. Each chapter provides information for understanding of the researcher main idea for conducting research on this topic.

Chapter one introduces the topic to set the foundation for the research by discussing the consequence of the pandemic on the European stock market. It outlines the motivation for conducting the research, the key objectives, and the research questions.

Chapter two focus on literature review, which forms the theoretical base of the research. It combines insights from prior academic works on COVID-19.

Chapter three focuses on the methodological framework of the research. It explains the research design, context, and procedures used for collection of data and analysis. The detailed descriptions of the selected variables and the crucial statistical techniques such as correlation and descriptive analysis are provided.

Chapter four lists the results and analysis of the study. This chapter is divided into two parts while making analysis to allows for a comparative examination of how market dynamics, risk factors, and investor sentiment evolved before and after the crisis across European markets.

Chapter five provides a discussion of the main results of the study. This chapter analyse the findings, identifies their importance for investors, policymakers. Finally, the research presents the conclusion and discussion chapter six.

2 Literature review

In this section, this study observes the previous research which is worth and relevant to compare with this research. This section is based on observing the stock market situation of the major European and Nordic economy in the wake of Covid -19.

Here, while conducting this review the author wishes to receive suggestions, new information and ideas to move forward with other sections and show the competency to conduct the thesis successfully. It is worth saying that literature review is a flexible multi-step process that continuously evolves over time with the support of various formal and informal guides (Juntunen & Lehenkari, 2021).

2.1 COVID-19

In the year 2020 the world came across a wide spread of the virus which in a matter of no time known as a deadly transmittable disease. The virus spread so fast around the world that it started challenging the countries to take actions which disrupted society and the global economy. The countries were forced to implement travel bans, lockdowns all over the world (BBC, 2020). The virus was called as Covid-19.

The virus that shocks everyone around the world was recorded first in China. The virus was believed to be discovered in a dirty fish market in China with no proper evidence of its transmission from the animal to human. China has imposed travel bans around the country imposing the strict lockdown, but the case has already gotten worse before the China could do anything. The infected people have already travelled all around the world transmitting the virus to other people in contact which led to global threat. Soon enough all the countries around the world were struggling to manage the increasing number of Covid-19 cases. On the one hand, every country around the world has imposed lockdowns, travel bans, quarantine camps to keep their people safe. On the other hand, the situation escalated and caused millions of deaths around the world within the matter of no time. The hospitals, health centres could not provide enough service to the infected people due to lack of enough facilities, likewise the doctors, nurses and people in the health sectors were having difficulty to maintain increasing chaos in the hospitals.

The Covid-19 has affected economy all around the world. The virus not only destroyed the people lives it also destroyed the countries economy and forced the countries to step back, the businesses were shut down, the tourism industry was totally collapsed, the stock markets were negative, over the span of one year the world faced the greatest financial crisis (Financial Times,2020).

The virus shattered the million dreams, the children's were banned from going to school, thousands of people became homeless, many lost their parents, families were destroyed. The difficult time lasted for a year or two, but the impact created by the pandemic became long lasting. In the year 2020 the vaccine for the virus was introduced, the vaccine was soon, given to all hospitals and to the people affected. The vaccine was designed to boost the immune system and fight against the virus which soon started working and the deaths which were in thousands, started decreasing slowly to hundreds. The virus did not discriminate it was all over, even the richest people, the celebrities and everyone were suffered, the situation was difficult as people were afraid of people. The communities were drifting apart.

During the pandemic, the economic condition of most of the developed and developing countries was vulnerable. Even the world economy went into recession because of economic markets crashing. The GDP around world was drastically decreased (IMF, 2021). Most of the big businesses were shut down, thousands of people lost their job, thousands were laid off. Big economies like Germany, UK, China, Japan all were struggling. The stock market was crashed. The countries like Uk, Germany, even the Nordic countries like Finland, Sweden, Denmark all were struggling. These countries with strong manufacturing industries rely heavily on export business, due to disruption in global supply chain the countries suffered huge loss.

In Finland, the data shows that the covid-19 pandemic has seen to be increased around the year 2022, where the government have imposed restrictions, but by end of 2023 with the decrease in the number of cases the restrictions were lifted (Tiirinki et al., 2024). It is seen that the stock market index for Finland have declined 25 to 30% in the early 2020. Even though the country has announced the end of the pandemic by the year 2023 the overall inflation is expected to continue for coming years.

The countries like Sweden and Denmark have been equally affected by Covid-19. The stock market in these countries went down along with the spread of the pandemic. These countries also imposed the restrictions like other countries. As per the data, the deaths reported in these countries reported to be highest in Sweden, followed by Finland, Denmark and Norway (Nielsen & Lindvall, 2021). The countries managed to impose the policies on time, while the citizens trusted their government the coordination worked in the favour to some extent to fight against the deadly virus.

2.2 European Stock Market in the Wake of Covid-19

European stock market is one the biggest stock market around the world. The pandemic Covid-19 caused a huge supply chain disruption around the world. The export businesses faced a huge tragedy; the markets were completely shut down due to which the countries faced economic recession. The stock markets were crashed, leading to a great depression in the European economy. The lockdowns and the restrictions imposed, put a consumer demand to a stop, due to which larger number of people lost their jobs, increasing the unemployment rate across Europe (Baldwin & Weder di Mauro, 2020). The European Union is slowly developing a new recovery plan after the devastating pandemic.

Nordic countries remained no different from other European countries during the pandemic. They struggled with the pandemic; however, the countries have maintained the strong degree of economic stability and were able to cope well. On the one hand, in the context of pandemic Sweden decided to impose fewer restrictions initially, which became widely debated, however the decision worked well for Sweden and the country has a slow GDP decline. Even though the decline in GDP was low compared to other Nordic countries Sweden faced more severe health consequences, resulting in higher health costs (Andersen et al., 2021). On the other hand, the countries like Denmark, and Finland had a stricter lockdown in the initial phase of pandemic. The countries opted a strict rules and regulations, even the business closures, due to which the GDP declined sharply for these countries in the year 2020 but this decision has a positive impact which caused reduced excess mortality rate around the countries. As the Nordic countries have good resources and high-end technologies the government had a chance to use these resources to support the business and households to ease the transition from the physical work to remote environment. This helped the

countries to cope with the economic shock and supported the businesses and countries to recover quickly (Andersen et al., 2021).

There are many research that explored the movements of the European market during the time of pandemic. The research where the data of twelve European countries was taken using intraday, where the researchers has used five minutes time interval to see the interconnectedness of the market ups and downs (Aslam, 2021). The European markets were very connected during and after the time of pandemics. The researchers Aslam, Ferreira, Mughal, and Bashir (2021) compared the time before and after the pandemic where the analysis suggested that markets links became much stable after pandemic situation.

2.3 Risk Return Analysis

The concept which describes the connection between the uncertainty of the investment and predicted outcome is risk return analysis. The concept examines how much reward can be achieved with a certain level of risk in an investment. Investors can take different level of risk for gaining the reward in an investment. For an investor returns can be realised through safe assets, such as government bonds, which usually provides lower but more stable returns. Likewise, the investors need to deal with riskier assets such as stock which offers a higher return but also show greater price fluctuations.

Risk return analysis allows investors to evaluate whether the return they expect is reasonable compared to the risk they are taking. There are some types of risk which can be reduced through diversification, which involves investing in a variety of assets rather than relying on a single investment (Markowitz, 1999). Risk return analysis is influenced by various factors. It includes market volatility, investor behaviours, company size, economic condition of the country, along with other essential factors including the time horizon. The idea of risk return revolves around mainly two concepts.

Risk is the crucial factor in any type of investment, it shows if the actual return may be different from the predicted return. In other words, risk is the factor which shows an uncertainty of any kind of investment. Systematic Risk and Unsystematic Risk are major risks for market or any company.

2.3.1 Systematic Risk

Systematic risk is called market risk, which cannot be diversified, which means it can affect the entire market or a large portion of the market. This type of risk always arises beyond the control of the market or companies. Systematic risk can be problematic for the market because it affects the market and all companies to some extent. While it cannot be eliminated through diversification but can be measured by factors called Beta (β) and capital assets pricing model which shows how sensitive the investment can be to the overall market. According to Ciciretti et al. (2025), the development of early-warning risk signals using graph theory provides a powerful mechanism for identifying and anticipating shifts in systematic risk within financial markets.

The examples of the systematic risk can be political instability due to change in political factors, global pandemics or a crucial war situation, change in interest rates, changes in the price rates, economic recession and many other contributing factors. For investors it is very essential to know about the risk, if the risk cannot be eradicated it can be mitigated through asset allocation, or diversification of investment globally along with that investors can also use hedging strategies.

- **Political Factors.** These are the major factor which influence the market and its overall activities. The political factors are very crucial in the world where trade is interconnected. The countries throughout the world are participating in the global trade. In this situation the political instability in any country can turn down the growth and return of an investment. Political instability in any country can led to economic crisis, even change in rules and regulations can hamper the entire economy, therefore this risk should be monitored (Chuliá et al., 2023).
- **Economic Recession.** The economic recession can cause, the decline in GDP, increase in unemployment within the country. The rise in price, rise in the interest rates, wars and natural disasters can trigger the economic recession.

2.3.2 Unsystematic Risk

The type of risk which lies within the company rather than the outside environment known as unsystematic risks. This type of risk is industry or company specific meaning it is affected by the

internal activities of the organisation. This type of risk affects the company internally. The major factor contributing to unsystematic risks are labour decisions, workers dispute within an organization, unhealthy competition inside an organization, management decisions and sometimes even the company policies. Unsystematic risk is calculated by using the formula:

$$\text{Unsystematic risk} = \text{Total Risk} - \text{Systematic Risk}$$

Investors in the company can be free from this type of risk through diversification of the portfolio. When investors invest in the market it involves the certain amount or risk (Bhatia, 2022). This means the risk escalates with volatility, making a crucial environment to understand both risk systematic and unsystematic risk. This is important for an investor because it helps to make a well-balanced decision. The unsystematic risk is financial risk, operational risk.

- Financial risk. Is always present in the company, the financial risk is in the form of capital structure. In order to run business smoothly the company needs a good capital structure which means the company needs a good level of debt and equity structure. The good capital structure is essential to fulfil the financial obligation of the company.
- Operational Risk. The risk can be caused due to many factors. It is very important for a company to manage its operation smoothly. If the operations of the company are not managed smoothly it can lead to supply chain breakdown, failure in operating machines. Other than that, a company can be in a serious threat due to data breach due to operation system failures.

2.4 Capital Assets Pricing Model

Capital assets pricing method is a framework which helps to explore the connection between the uncertainty of an investment and reward it may offer. As investing involves a certain amount of uncertainty, the investor making an investment expects the amount of return to be compensated for two key components, the risk investor is taking for investing in the market and the time value of money.

The concept says the amount of money for example a euro invested today will be more valuable in the future because of the interest involved in it. Capital Assets pricing Model by Doan (2017) explains that it has been widely used in the world of finance as a powerful implication in risk and return analysis as well as analysing the performance of the stock. On the other hand, investors require a risk premium, beyond the time value of money, carry on with the uncertainty of market movements. The premium set helps to compensate the investors when they are exposed to market risk which cannot be diversified away. Here, the magnitude of the risk premium depends on mainly two factors, the first influencing factor is Beta. This helps to check the sensitivity of the assets; another factor is market risk premium which is the difference between anticipated return on market portfolio and risk-free rate.

This figure is adapted from Logue (2025), who explains the components of the CAPM as it is a math formula which has been written in different words for years but still holds a basic concept. CAPM is calculated = $E(R_i) = R_f + \beta_i(R_m - R_f)$

Capital asset pricing model (CAPM)

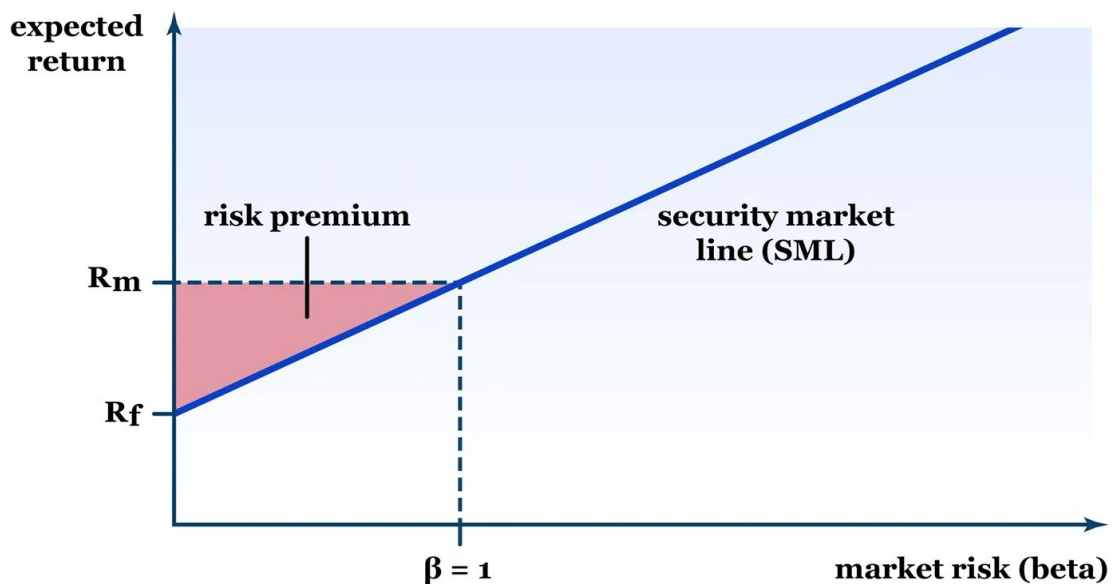


Figure 1. Capital Assets Pricing Method

In the context, $E(R_i)$ is considered as the predicted reward on investment, where (β) measures the assets sensitivity, and known as beta coefficient. Likewise, risk-free rate is R_f , the return on market portfolio is R_m .

Hundal (2019) suggests that risk and return is not only just a topic but a foundation, as well as a topic for interest for investors throughout the journey of finance from old times to modern finance. The concept of CAPM developed in the early 1960s, as a foundation for modern portfolio theory, which later was developed by William Sharpe in 1964 as a recognized theory, continuing the research study by other researchers to which added more approach to theory.

2.5 Portfolio Theory

Portfolio theory is a key idea in modern finance, it demonstrates how investors can structure their investments to create a balance between risk and potential returns. The fundamental concept of portfolio theory is that individuals make rational decisions which favours the lower risk when they anticipate the same level of return. There are various type of assets which do not move together, investors used this method for diversification which allows them to allocate capitals to these assets. For an investor this method helps them to diversify their assets in a way which lower the risk of investment. The clustered portfolio helps to reduce the risks therefore holding a diversified portfolio is better for an investor rather than investing in an individual portfolio.

For an example, a portfolio of an investor consists of two assets X and Y. When the correlation coefficient of the assets X and Y is -0.8 which is an extremely negative correlation. The overall risk of the investment is reduced because, the assets balance each other which means if the return on assets X goes up the return for assets Y goes down and vice versa. If the assets are moving in opposite directions, they help to reduce the overall investment risk. This figure is taken from the article published by Logue (2025).

Capital market line (CML) and the efficient frontier

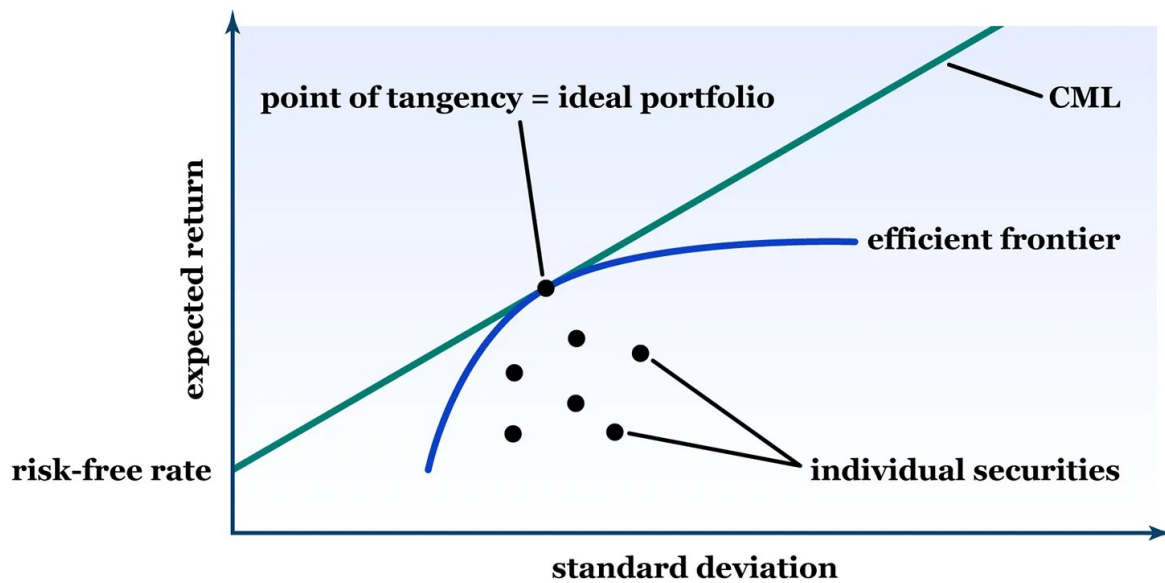


Figure 2. Portfolio Theory

The total risk of the portfolio is not determined by the risk of one particular asset alone. It rather also depends on the correlation between the returns of various assets which indicates how they are linked to one another (Markowitz, 1999). The overall risk of the portfolio can be decreased by offsetting assets that move in opposing directions.

The ideas introduced by Markowitz created a base for other important finance models, such as the Capital Market Line (CML) and Security Market Line (SML). These models are built on the concept of diversification and connect it with the Capital Asset Pricing Model helping the investors understand expected returns while considering market conditions. The portfolio theory gives investors a practical way to manage risk and make smart investment decisions

2.6 Arbitrage Pricing Theory

A financial tool which helps investors to understand how the expected yield of a stock is influenced by many macroeconomic factors. The factors include interest rates, inflation, GDP growth, changes in oil prices and so on (Ross, 1976). This model assumes that each stock has a sensitivity corresponding to these macroeconomic factors. Therefore, the expected return is determined by

the influence of all the relevant factors. This theory uses many systematic risk factors to explain the assets return unlike the capital assets pricing method. This theory explains about the linear relationship between the risk and the expected return of the assets.

This theory says if the stock is not priced relative the macroeconomics the investors can exploit this as a loophole. This means through arbitrage an investor can earn a risk-free profit until the stock price adjusts to its fair value. Therefore, investors can construct portfolios that neutralize the factor risks and capture mispricing opportunities in the market. Over time, these arbitrage activities help align stock prices with the economic reality of the factors affecting them (Bodie, Kane, & Marcus, 2014).

In practical terms, arbitrage pricing theory is widely used in stock market analysis and portfolio management. To reduce undesirable risk fund managers often consider multiple macroeconomic variables when selecting stocks to achieve better risk-adjusted returns. By using arbitrage pricing theory, investors can create diversified portfolios that account for the sensitivity of each asset to different economic factors. This helps investors to minimize the unsystematic risk while managing systematic risk effectively (Elton et al., 2014). Hence, APT is a one of the most flexible and powerful tools for making decision while investing in real-world financial markets.

2.7 Research hypotheses

The research hypothesis is presented below:

Hypothesis 1: The Covid-19 pandemic has a negative impact on the risk-return performance of Nordic and Major European stock market indexes.

Hypothesis 2: The risk-return performance of the selected indexes was significantly stronger pre-pandemic than during and post pandemic.

Hypothesis 3: The post-Covid recovery in risk-returns performance was faster in Nordic stock markets compared to major European markets.

3 Research Methodology

3.1 Research context

The pandemic caused unimaginable losses to the economy of the countries around the globe. The financial markets all around the world also suffered a similar fate where the market experienced a decline in almost all sectors. This study is to understand how the Nordic and the European market reacted to this global crisis and how the market recovered after the crisis. The context of the research is wide as this research tends to cover the important Nordics index such as OMX Helsinki 25, Nordic 40, OMX Stockholm 30, OMX Copenhagen 25, DAX Germany and also FTSE 100 UK. Nordic markets are known for their stable fiscal structures and strong digital economies but during the time of pandemic these markets showed relatively more resilient behaviour than the major European markets. The pandemic hit the global market so hard the recovery from the pandemic has been a nightmare for the economies in some developing countries, even after many years, the countries are still struggling to get back to a stable economy.

Studying the Nordic and European market is meaningful as both markets serve a strong economy, with steady financial structure, only with the slightest structural and policy differences. European economies are characterized by having larger industries with more diversified markets, on the other hand Nordic markets are usually export based markets with strong social welfare systems. Therefore, these market contrasts make this research important to explore how both groups' equity markets reacted and recovered from the pandemic shock. This study draws open the portfolio, risk return, CAPM theories to find out how well the frameworks did during the crisis situation. The pandemic also provides an opportunity to observe if the markets are efficiently adjusted to new information. While different research studies have examined the severe global market response to covid -19, only limited research studies have pointed out comparing the Nordic and European Equity markets. This study fills the research gap by providing in-depth analysis of market performance, risk return analysis offering new insights into global resilience and investment implications.

3.2 Research design

3.2.1 Research purpose

This study is presented to understand how the global pandemic affected the equity market in the Nordic and the major European regions. It is aimed to compare how these markets responded to the pandemic by analysing the situation of the market performances and the volatility before, during and after the pandemic. The research aims to understand how the pandemic influenced the market behaviour and also helps to identify the important factors that contributed for the market recovery and resilience across Nordic and European regions. For the policy makers, researchers, investors, it is crucial to understand how the equity market reacted and responded during covid-19 especially, it is important for the big economies as the major changes in big economies can influence the global market. In this context knowing which economy has been resilient is very important as the pandemic has created high uncertainty in the market. By focusing on Nordic and major European regions this research will provide an understanding of fiscal and monetary factors influencing market performance during the global crisis.

Overall, this research purpose is to analyse the comparative analysis of the performance and recovery patterns of the selected indexes which serve as major strong economies in the European market. By examining the indexes this research will show how markets reacted and quickly recovered from the pandemic.

3.2.2 Research Method and Time horizon

This research uses the quantitative method. It focuses of the quantitative study to analyse the stock market data. The research spanned the time period of 6 years from 2018 to 2024 which includes the period before the Covid-19, during the Covid-19 and the period after the Covid-19. This helped to understand the relative trend of the equity market in different time frames.

3.3 Data collection

For this research the data was collected from the publicly available and reliable sources which includes the Euronext official website and NASDAQ European market activity portal which provide

the regularly updated daily and the historical market data. The research data includes both Nordic and major European indexes. The data used for the calculation consists of daily closing price for the given index which is directly downloaded from the price sections in Nasdaq and Euronext as well as investing.com, all websites provide the free reliable data that can be used for the research purpose.

The data is being collected from March of 2018 to December of 2024 which includes the Pre-covid time period, during the pandemic and post-pandemic period. During the data collection process, some days were excluded as non trading days, such days where the stock market was closed, to ensure that daily data points are consistent in all the indices. The number of days taken for calculation is 252 as it is usually considered as the average trading day in Nasdaq. Likewise, the decision to use the particular websites for data collection is justified by their status in the global stock market as they are the most prominent leading global market exchanges. Nasdaq serves as a major marketplace for trading and is a host for many largest technology companies, while on the other hand Euronext provides comprehensive information about the European equity market including the Nordic region.

3.4 Description of Variables

This research looks at the financial performance and risk to compare how Nordic and major European stock markets act during the pandemic period. The variables generally help to measure the overall performance and risk adjusted performance to show how markets performed during the stressed market situation. This study mainly focuses on four key variables, risk, return, beta, and CAPM alpha. As it is known, these variables are widely used variables, in the finance world, for the market analysis to assess the performance and volatility of the market. The chosen variables are applied to each selected index for calculating and evaluating the market behaviour during the different phases of pandemic.

Return

The percentage change in index's value over time indicating the profitability or performance of the market is usually considered as return. Return can be calculated on a daily basis or also can be calculated on an annual basis. Usually, average daily return is calculated on a per day basis using the

typical 252 trading days. Here, as per the data collection of the various indices, the closing price of the day is used. The formula for calculating.

$$\text{Average Daily Return} = ((P1 - P) / P)$$

Where P denotes the closing price yesterday, p1 denotes the closing price today.

$$\text{Annualized Daily Return} = ((1 + \text{Daily Returns})^{252} - 1)$$

On the first hand this transformation helps to convert daily return into annual basis which enables a meaningful comparison between the indices across the different time periods. On the other hand, it also helps identify which market showed a stronger recovery and investment potential following the pandemic situation.

Risk

The financial market is uncertain, and the investor might not always get the returns as expected, sometimes returns exceed the expectations and sometimes returns fall far below the expected returns. This uncertainty is known as the risk in the investment. Risks can broadly be classified to be of two types: Systematic Risk and Unsystematic Risk. Systematic risk is the market risk which affects the whole market and cannot be diversified to reduce it; however unsystematic risk is dependent on a particular sector of companies which can be reduced by diversification. The formula for Risk calculation:

$$\text{Daily Risk} = (\text{STDEV.S}(Y1: Yn))$$

$$\text{Annual Risk can be calculated as } = (\text{STDEV.S}(Y1:Yn) * \text{SQRT}(252))$$

While calculating higher volatility will indicate a more unstable market likewise, the lower suggests stability. This calculator will suggest which markets were more resilient and less affected during the pandemic.

Beta

The beta is the statistical tool that measures the sensitivity of the particular asset with respect to the movement of the market. It quantifies the change in the expected return in response to market fluctuations. Mathematically, Beta is expressed as:

$$\beta_i = \text{Cov}(R_i, R_m) / \text{Var}(R_m)$$

Where:

- β_i = Beta coefficient of the asset
- R_i = Return of the individual asset
- R_m = Return of the market portfolio
- $\text{Cov}(R_i, R_m)$ = Covariance between the asset and the market returns
- $\text{Var}(R_m)$ = Variance of the market returns

Beta (β) measures the systematic risk of a stock or portfolio relative to the overall market.

CAPM

CAPM is one of the most important models in the modern financial market. It is measured by using the beta mentioned above. Hence this model explains the relationship between the return expectations and the systematic risks.

Mathematically, CAPM is expressed as:

$$E(R_i) = R_f + \beta_i(R_m - R_f)$$

Where:

- $E(R_i)$ = Expected return of the asset
- R_f = Risk-free rate of return
- β_i = Beta coefficient of the asset (measure of systematic risk)
- R_m = Expected return of the market portfolio
- $(R_m - R_f)$ = Market risk premium

3.5 Data Analysis

In this study, after the process of data collection, the data were stored in the Microsoft Excel worksheets. The various data were calculated using the different tools and formulas. This data analysis focuses on understanding how markets reacted and evolved under economic uncertainty and what are the factors influencing the recovery of the market.

The daily closing prices of the indices, OMX Helsinki 25, Nordics 40, OMX Stockholm 30, OMX Copenhagen 25, DAX 30 Germany, FTSE 40 UK were obtained from Nasdaq and Euronext, where all the data are freely available. The data that are used for the calculation were divided into two periods, pre covid starting (01.03.2018- 29.02.2020) and during/ post covid (01.03.2020- 28.12.2024). As mentioned above in the data collection, non trading days were removed and daily logarithmic returns were calculated using, $R_t = \ln(P_t/P_{t-1})$, in which daily return is R_t , P_t is the price at the day end, and P_{t-1} is the price at the end of previous day.

Furthermore, descriptive statistics is calculated, to understand the volatility patterns and to know about performance trends, in the Nordic and European markets. Likewise, annualised returns, volatility are analysed which helps to assess risk and performance. CAPM is also calculated to analyse the risk-adjusted performance.

Overall, all analyses are performed using excel and SPSS as stated above all the findings from the analysis, interpreted in relation to research objectives and framework.

3.5.1 Descriptive Statistics

Descriptive statistics are used in this study to summarize and explore the basic characteristics of daily stock return data for the selected Nordic and major European indices. Measures such as the mean, standard deviation, range, minimum, and maximum are calculated for all selected indexes. The calculation of these parameters helps in understanding the market behaviour before and after the Covid-19 pandemic. The descriptive analysis serves as an immediate step before conducting correlation analysis to ensure that the data is consistent and suitable for further statistical testing. The actual results of the descriptive statistics are presented in Chapter 4.

3.5.2 Correlation Analysis

The primary goal of correlation analysis is to check the relationship among the selected variables. This method helps us to find and understand how the different indexes are connected to each other and how they interact in different time period. It helps to understand whether the pandemic had a positive or a negative market performance during specific years.

The correlation is represented by r , it also indicates the positive and negative relationship between two variables which ranges from -1 to +1. A value of 0 indicates there is no linear relationship between the variables, while -1 represents the perfectly negative correlation and +1 represents a positive correlation. For this research study, a significance level of 0.05 has been selected. Correlations that do not reach significance at this level will be viewed as less reliable.

4 Results

In this fourth chapter, the findings of the study will be discussed, including Descriptive statistics and Correlation analysis. The findings will be shown in two periods Pre and Post Covid ensuring a clear analysis and highlighting changes in market behaviour and intermarket relationship.

4.1 Descriptive Statistics: Pre-COVID-19

The table below shows the descriptive statistics of daily returns for the selected indexes during the pre-Covid-19 period. The mean returns are close to zero, which indicates a stable market performance, while standard deviations range between 0.0077 and 0.0094, reflecting relatively low volatility. Nordic markets such as OMXH25, OMXS30, and OMXC25 show slightly lower volatility than major European markets like DAX 20 and FTSE 100, suggesting modest differences in risk.

Descriptive Statistics of Daily Returns (2018–2019)

<i>Index</i>	<i>Range</i>	<i>Minimum</i>	<i>Maximum</i>	<i>Mean</i>	<i>Std. Deviation</i>
DAX 20	0.068454	-0.03475	0.0337	0.00002	0.0094
FIST 100	0.055833	-0.03231	0.02353	0.000002	0.00771
OMXC 25	0.06224	-0.03732	0.02492	0.00025	0.00879
OMXS30	0.058576	-0.0286	0.02997	0.00025	0.0093
Nordic 40	0.056118	-0.02576	0.03036	0.00015	0.00866
OMXH25	0.061087	-0.02901	0.03208	0.00014	0.00939

Table 1.Descriptive Statistics (Pre-Covid19)

The subtle difference suggests that Nordic markets carried marginally lower risk and tended to experience smoother daily returns during the pre-pandemic period. It is seen the variation in volatility is not extreme, which suggest structural differences between smaller, regionally focused markets and major European benchmarks.

Overall, the period before the crisis is seen to have moderate daily returns and low volatility, indicating a stable market environment. According to findings, Nordic markets exhibited slightly lower volatility compared to major European indices, suggesting modestly lower investment risk.

4.2 Descriptive Statistics: During/Post-COVID-19

Table 4.2 presents descriptive statistics of daily returns for the post-COVID-19 period. The findings suggest that standard deviations increased across all indices, reflecting heightened volatility and market uncertainty.

Descriptive Statistics of Daily Returns (2020–2024)

<i>Index</i>	<i>Range</i>	<i>Minimum</i>	<i>Maximum</i>	<i>Mean</i>	<i>Std. Deviation</i>
DAX 20	0.232145	-0.12239	0.109759	0.000405	0.013041
FIST 100	0.199279	-0.10874	0.090535	0.000119	0.010949
OMXC 25	0.121153	-0.08029	0.040864	0.000349	0.01191
OMXS30	0.176601	-0.10571	0.070891	0.000342	0.01218
Nordic 40	0.159899	-0.09818	0.061717	0.000375	0.011929
OMXH25	0.170201	-0.10128	0.068918	9.2E-05	0.012172

Table 2.Descriptive Statistics (Post Covid-19)

On the one hand, the range of daily returns also widened, indicating stronger fluctuations during and after the pandemic. On the other hand, it is seen that mean returns remained close to zero, which suggests that overall returns balanced despite the higher volatility. Analysis also shows that Nordic indices continued to exhibit slightly lower volatility than major European indices, implying relatively faster stabilization.

The post-COVID-19 period shows higher volatility and along with the wider range of returns, which clearly shows the disruptive effects of the pandemic. Nordic indexes exhibited slightly lower volatility, suggesting relatively faster recovery and stabilization, than the major European indexes.

4.3 Correlation Analysis

Correlation analysis was conducted using yearly daily returns for the selected Nordic and major European stock indexes. Pearson's correlation coefficient (r) was calculated to measure the degree of co-movement between indexes each year.

4.3.1 Correlation Analysis Pre-Covid 19 (2018-2019)

The period for analysis before Covid-19 in this research is from the year 2018 to the end of 2019. This section examines the movement of the major European and Nordic indexes using daily return correlations. The indexes included are DAX20(Germany), FTSE100(UK), OMXC25(Copenhagen 25), OMXS30(Stockholm 30), OMXH25(Helsinki 25), and OMXN40(Nordic 40). Pearson's correlation coefficient(r) is calculated on SPSS with statistical significance as follows:

* . Correlation is significant at 5% level

** . Correlation is significant at 1% level

In table 1 (2018), the correlation shows several significant relationships among different indexes. Germany has shown a moderate positive correlation with the Nordic indexes, including Copenhagen 25 at 24%, Stockholm 30 at 28%, Nordic 40 at 26%, and Helsinki 25 at 25%. Among the Nordic indexes Stockholm 30 and Nordic 40 show a particularly strong correlation 90%, while Copenhagen

25 is moderately correlated with Stockholm 30, Nordic40, and Helsinki 25 (37% to 50%). In addition, the UK shows a low correlation with all other indexes indicating a minimal co-movement in the market.

	DAX20	FTSE100	OMXC25	OMXS30	OMXN40	OMXH25
DAX20	1	-0.05	0.24**	0.28**	0.26**	0.25**
FTSE100		1	0.08	0.04	0.04	0.07
OMXC25			1	0.37*	0.5*	0.47*
OMXS30				1	0.9*	0.46*
OMXN40					1	0.46*
OMXH25						1

Table 3. Correlation Analysis (2018)

Overall, the results from table 1 shows that the Nordics markets were highly interconnected, while the UK remained relatively independent, and Germany showed only a slight alignment to the region.

In the table 2 (2019), correlations among indexes showed some changes from the year 2018. It can be seen that Germany has maintained moderate positive correlations with Nordic 40 at 39% and Stockholm 30 at 25%. While the UK shows weak correlations with other indices, with the highest being Stockholm 30 at 14% and Nordic 40 at 12%.

	DAX20	FTSE100	OMXC25	OMXS30	OMXN40	OMXH25
DAX20	1	-0.08	0.16**	0.25**	0.39**	0.25**
FTSE100		1	0.07	0.14*	0.12*	0.04
OMXC25			1	0.36*	0.44*	0.03
OMXS30				1	0.69*	0.39*
OMXN40					1	0.14*
OMXH25						1

Table 4. Correlation Analysis(2019)

Furthermore, within the Nordic region, the table shows strong correlations were continued, Stockholm 30 and Nordic 40 are correlated at 69%, and Copenhagen 25 with Stockholm 30 and Nordic 40 (36% to 44%). The results shows that Nordic markets continued to move together, while Germany showed moderate alignment and the UK remained largely independent.

4.3.2 Correlation Analysis During /Post Covid 19 (2020-2024)

The during and post covid period is considered for this research is from the beginning of 2020 to the year 2024.

In the year 2020 on Table 3, DAX20 and FTSE100 has shown a significant positive correlation at (0.79*), which indicates the aligned market movement.

	DAX20	FTSE100	OMXC25	OMXS30	OMXN40	OMXH25
DAX20	1	0.79*	0.25**	0.19*	0.31**	0.17*
FTSE100		1	0.13*	0.20**	0.29**	0.21**
OMXC25			1	0.20**	0.29**	0.21**
OMXS30				1	0.19*	0.91**
OMXN40					1	0.20**
OMXH25						1

Table 5. Correlation Analysis(2020)

Furthermore, within the Nordic indexes Stockholm 30 and Helsinki 25 showed a strong correlation at 91% while Copenhagen 25 has maintained moderate correlations with Stockholm 30, Nordic 40

and Helsinki 25 from (20% to 50%). The correlation indexes were raised indicating the market integration during the crisis.

	DAX20	FTSE100	OMXC25	OMXS30	OMXN40	OMXH25
DAX20	1	0.45**	0.27**	0.33**	0.29**	0.25**
FTSE100		1	0.34*	0.43**	0.41**	0.30**
OMXC25			1	0.47**	0.48**	0.28**
OMXS30				1	0.58*	0.49**
OMXN40					1	0.46**
OMXH25						1

Table 6. Correlation Analysis(2021)

The table above for the year 2021 shows, the correlations were elevated but they remained lower than 2020. On the one hand, it can be seen that FTSE100 showed stronger alignment with Nordic markets on the other hand Germany has maintained moderated correlation with Nordic Indexes. Moreover, Copenhagen 25 continues to move in line with Nordic indexes, suggesting a partial market stabilization after Covid-19 shock.

Within the Nordic region, correlations were seen strong, with OMXC25 showing 47% with OMXS30 and 48% with OMXN40, while OMXS30 correlated 58% with OMXN40 and 49% with OMXH25.

DAX20 maintained moderate correlations with Nordic indexes (25-33%), whereas FTSE100 aligned more closely with the Nordic markets.

	DAX20	FTSE100	OMXC25	OMXS30	OMXN40	OMXH25
DAX20	1	0.07	0.23**	0.36**	0.28**	0.15*
FTSE100		1	0.12*	0.28**	0.27**	0.15*
OMXC25			1	0.39**	0.52**	0.26**
OMXS30				1	0.54**	0.29**
OMXN40					1	0.52**
OMXH25						1

Table 7. Correlation Analysis(2022)

In the table above the correlation pattern is mixed. The Nordics indexes are correlated strongly being Stockholm 30 and Nordic 40 correlated at 52%. Likewise, Copenhagen 25 has maintained moderate correlations with other Nordic indexes from 26 to 52%.

However, DAX 20 and FTSE100 were (0.07, not significant) showing a minimal co-movement, indicating partial decoupling between these markets.

	DAX20	FTSE100	OMXC25	OMXS30	OMXN40	OMXH25
DAX20	1	0.45**	0.33**	0.44**	0.27**	-0.08
FTSE100		1	0.33**	0.47**	0.35**	-0.09
OMXC25			1	0.47**	0.47**	-0.10
OMXS30				1	0.49**	-0.08
OMXN40					1	-0.09
OMXH25						1

Table 8. Correlation Analysis(2023)

In the table above, it can be seen the correlations were moderate across most indexes. Germany and Stockholm 30 are correlated at 44% and Copenhagen 25, Stockholm 30 and Nordic 40 are correlated at (47 to 49%). The Nordic region has been in regular co-movement with each other while maintaining moderate alignment with Germany. Some negative correlations are seen in the table. Overall, 2023 reflects partial normalization, with moderate regional integration.

	DAX20	FTSE100	OMXC25	OMXS30	OMXN40	OMXH25
DAX20	1	0.46**	-0.09	0.13*	0.34**	0.46**
FTSE100		1	-0.10	0.07	0.31**	0.27**
OMXC25			1	0.35**	0.39**	0.32**
OMXS30				1	0.39**	0.29**
OMXN40					1	0.37**
OMXH25						1

Table 9. Correlation Analysis(2024)

In the table above, it is seen that across the Nordic markets, correlations remain consistently positive and moderate. It can be seen that OMXC25 correlates 35% with OMXS30, 39% with OMXN40, and 32% with OMXH25. OMXS30 also shows a 39% correlation with OMXN40 and 29% with OMXH25. OMXN40 and OMXH25 record a correlation of 37%. Moreover, the results suggest that Nordic markets were moving together and their correlation is on the mixed or weaker side with FTSE100 and DAX Germany.

5 Discussion

The results showed a changing pattern of market combination among markets from 2018 to 2024. Before the crisis period (2018–2019), the Nordic markets showed strong internal correlations particularly between Stockholm 30 and Nordic 40. While the Copenhagen 25 maintained moderate correlation with the other Nordic indices. Germany showed a moderate correlation with the Nordics whereas the UK remained independent showing its relative market isolation.

The emerge of Covid-19 in 2020 sparked a sharp increase in correlations across most markets, with Germany and the UK showing strong alignment at (0.79) and Stockholm 30 and Helsinki 25 in the Nordic region exhibiting extremely strong correlation at (0.91). On the one hand, it is seen that from 2021 to 2024, correlations gradually stabilized, showing that Nordic indices remained closely linked, while on the other hand Germany maintained moderate connections, and the UK largely decoupled. These results show that the pandemic caused a short-term increase in how closely markets moved together, followed by a return to normal, while Nordic markets stayed closely connected.

Hypothesis 1: The Covid-19 pandemic has a negative impact on the risk-return performance of Nordic and Major European stock market indexes.

The data analysis prepared and conducted for the research supports the hypothesis 1. The pandemic negatively affected the risk-adjusted performance of Nordic and major European stock market indexes. In the year (2018–2019), which were the period before crisis the correlations between the indexes were mostly low or moderate. This analysis directly suggests that the markets moved somewhat independently, allowing investors to reduce risk through diversification. It is also seen that during the Covid-19 period (2020–2021) the correlations have increased sharply.

The results shows that DAX20 and FTSE100 showed a strong correlation of 0.79. Likewise, at 0.91 Nordic indexes OMXS30 and OMXH25 are perfectly correlated. The markets started to move together as a result of rise in correlation, reducing the diversification benefits and increasing the overall market risk. The pandemic caused uncertainty and fear, among investors which led them to react similarly across all markets. Correlations have started to decline in the year 2020 to 2024 but

remained higher than before the pandemic. Because of this some indexes to turn slightly negative, showing the markets were stabilizing but had not fully returned to normal.

Hypothesis 2: The risk-return performance of the selected indexes was significantly stronger pre-pandemic than during and post pandemic.

The performance of the selected markets indexes was stronger before the pandemic than during and after the pandemic period. This means, the markets showed more stability and moved relatively independent. On the one hand the results suggests that it allowed investors to manage risk more effectively and achieve better performance supporting the hypothesis. While during the pandemic, market conditions changed sharply, the outbreak has created high uncertainty and volatility, causing most markets to move in the same direction. On the other hand, the results also suggest that pandemic reduced the benefits of diversification and increased overall investment risk which forced the investors to face greater difficulty in maintaining stable, risk-adjusted returns.

Furthermore, the analysis shows in the years following the pandemic, market behaviour began to stabilize but did not fully return to pre-pandemic conditions. The aftermath of the crisis has continued to influence not only the market performance but also the confidence of the investor. Overall, the study shows that the pre- crisis time offered a more suitable environment for the investors with lower market volatility and better opportunities for diversification than the pandemic period. Even the years after were marked by higher uncertainty, closer market movements and the weaker risk-adjusted performance.

Hypothesis 3: The post-Covid recovery in risk-returns performance was faster in Nordic stock markets in comparison to major European markets.

The results suggests that the post covid recovery was also in faster in the Nordic markets than in the other major big European markets. The markets were seen to be working much faster after the pandemic, and investors were seen to be gaining the confidence to invest again. While, in the major European markets the change was slow, the markets were moving independently and comparatively slower than the Nordics. The markets were driven with uncertainty for a longer period. The main reasons behind the slower recovery were, the markets were affected more by the pandemic, the

disruptions were huge, and supply chain was damaged badly. Overall, the results support this hypothesis.

6 Conclusions

The study revealed and concluded that the pandemic created a strong effect across all markets causing the rise in volatility and a sharp surge in market integration. Before the pandemic the Nordic and the European markets exhibited moderate co-movement while the Nordic markets were more internally interconnected, and the UK was more or less independent. This diversified market scenario was changed during the pandemic when the crisis caused the market to behave similarly. The Nordic and major European markets experienced decreased risk-return performance during the pandemic. The Nordic markets showed more stability in the volatility levels compared to the European markets.

6.1 Recommendations for future research

The future works that could expand on this research study by including the following:

- Including the sectoral analysis: The future work can incorporate how the specific sector or industry responded to the global pandemic.
- Integration of the Macroeconomic Parameters: The macroeconomic parameters (GDP growth rate, interest rates, inflation etc.) in the research could help to expand the scope of the future research.
- Use of advanced economic techniques: The future research could use the time varying correlation models and machine learning to get insight into the non-linear relationship during the pandemic or any other crisis period.
- Expanding the focus area: The future studies can incorporate the cross-continental effects of pandemic or even the global ones so that the broad generalization could be made about the impact of the pandemic.

6.2 Limitations

- **Data Scope:** The study relied on the daily closing price of the selected indices. This doesn't fully capture the intraday volatility and sector specific differences that affect the dynamics of the market.
- **Macroeconomic Variables:** The study did not include the variables such as the GDP growth, interest rates, inflation and other macroeconomic parameters.
- **Assumption of Market Efficiency:** The application of the CAPM and portfolio theories which assumes the market to be semi-efficient. In real world scenarios behavioural biases of the investor and policy of government deeply influence the market and may violate these assumptions.

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